THE GALLATIN FOSSIL FOREST

HENRY N. ANDREWS AND LEE W. LENZ

The petrified forests of Yellowstone National Park have been a source of wonder ever since the early explorations of Jim Bridger, and that wonder grew into a more realistic admiration of geologic time and the forces that preserve plants through the ages following the studies of Dr. F. H. Knowlton during the latter years of the last century. In spite of the fact that some of the plant names in Knowlton's monograph would probably meet with revision in the hands of a present-day paleobotanist of Tertiary floras, it is likely that it will always stand as a classic in the annals of the science. It brought to light a flora, or more correctly a series of floras, strikingly different from the one that exists there to-day, and it made generally known the most spectacular of all petrified forests.

Fossil forests representing diverse ages in the earth's history, various modes of preservation, and a wide range of plant groups have been acclaimed by numerous authors. Perhaps the best known of all are the petrified trees of Arizona, although there the wood is, for the most part, too highly replaced to be of botanical value, and the great trees were transported some distance from their original habitat prior to petrification. Certainly among the most unique fossil floras, from the standpoint of the plants themselves, is the Devonian *Eospermatopteris* deposit near Gilboa, New York, and the Jurassic Cycad forest of the Black Hills. Unfortunately there is but little to be seen of these in the field. Through the work of the New York State Museum the "Dawn-seed-ferns" of Gilboa have been made to live again in an admirably executed restoration, and one may catch a glimpse of one of the earliest forests that existed on the earth. And we may be consoled in the knowledge that a large and representative series of the Dakota Cycads rests in security through the vigorous collecting activities of Professor Wieland. The same author has also given us a picture of the great Patagonian forest, especially remarkable for the prodigious abundance of petrified Araucarian cones that it has yielded.

In the coal balls and shales of the Carboniferous there is ample evidence of the Pteridophytic and early seed-plant forests that once covered so much of the globe, while occasionally, as with the Lycopod stumps preserved in Victoria Park, Glasgow, we see fragments of the forests in place. Another remarkable forest, preserved in a more precise sense of the word, is the one at Florissant, Colorado. Here a profusion of foliar remains, along with occasional representatives of the animal population, are preserved in volcanic ash beds immediately surrounding the stumps which were petrified in their original position in life. This is a rarely enough encountered combination of the trees and foliage that they bore. The impressions have been treated by a number of authors and are deserving of a comprehensive revision.

The discovery, in some abundance, of the silicified trunks of the Cretaceous *Tempskya* tree ferns in various of the northwestern states, and especially Idaho, has revealed a widespread and unique forest tree. But, like the Arizona petrifactions and numerous other western fossil wood deposits, these are not found in their original place of growth and hardly deserving of the term "fossil forest."

All of these forest remains of the past are important and distinctive in their own way and the age that they represent. Yet none of them can vie with the immense grandeur in both space and time of the Yellowstone forests. Nowhere else does there exist the succession of one forest directly above the grave of its predecessor—a succession that emphasizes perhaps more forcefully than any other plant fossil deposit the immensity of geologic time. Individually these forests attained ages well exceeding 1,000 years, and there is a minimum of no less than 16 of them extending one above the other.

The petrified forests in the Specimen Ridge region south of the Lamar River, being not far distant from the main stream of travel through the Park, are rather well known. It is the purpose of this article to focus some attention on the fine display of fossil forests in the extreme northwest corner of the Park. Although this is a region that is by no means unknown, it is certainly worth more attention than it has received from botanists and geologists, whether amateur or professional.

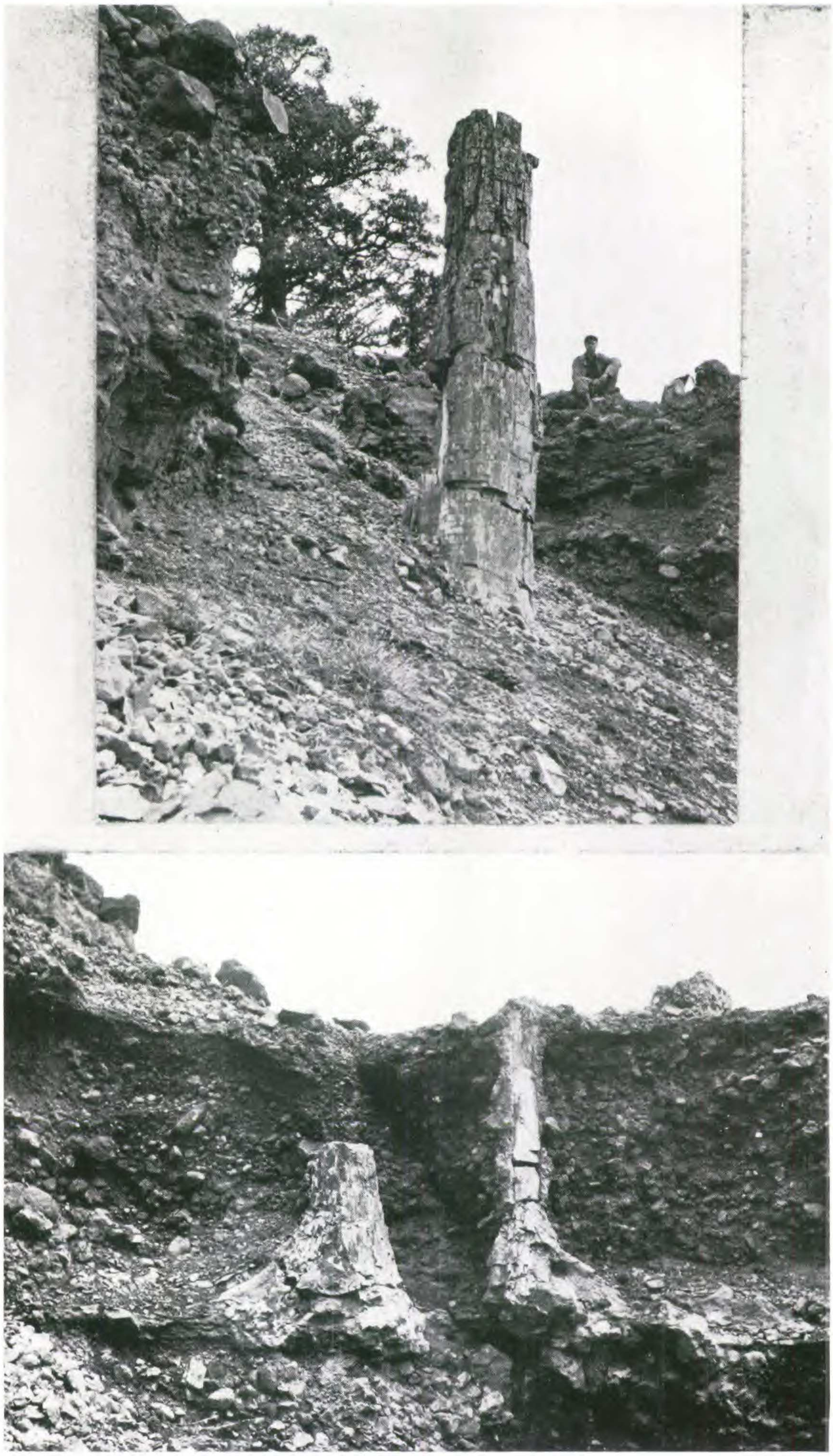
There is a fine camp ground about 300 yards up Specimen Creek from the Gallatin Canyon highway (Route U. S. 191), and shortly to the north there is noted a "Fossil Forest" on the U. S. Geological Survey's map of the Park. From our own observations the finest exposure of the forests is found about two miles northeast of this point considerably closer to the summit of Big Horn Peak. While it is quite possible to make the climb, see a good deal of the forests, and return to the camp ground on the same day, a two-day trip allows a more leisurely and profitable study.

An excellent trail leaves the highway and follows along the north side of Specimen Creek. Two unnamed tributaries may be noted on the topographic map flowing in from the north, the second of which departs from Specimen Creek about one and three-quarters miles from the camp ground. About a quarter of a mile north of the trail this divides into two branches which, for the sake of clarity, may be referred to as the West Fork and East Fork, although no names are designated on the map. On our trip of last summer we packed in provisions for overnight and set up camp about 200 yards north of the point where the two forks join.

The finest succession of fossil forests that were encountered occur on the southwest slope of the spur on either side of which the two forks flow. In ascending this spur petrified stumps were found at about the 8,000-foot contour, and splendid displays of at least ten successive forests were counted extending up the rocky exposed southwest face of the spur.

It is well to emphasize that figures given here are only approximate inasmuch as surveying instruments were not employed, and the number of forests given is a very conservative minimum. A "forest" was recorded only where a series of at

Upper: A petrified stump of *Sequoia magnifica* Knowlton, 14 feet in diameter.
Lower: A portion of the Gallatin fossil forest showing silicified stumps at three successive forest levels.



Upper: An exceptionally tall specimen in the Gallatin fossil forest. Most of the trees weather to within a few feet of the surrounding breccias.

Lower: Two stumps showing roots intact.

least four or five stumps could be traced along the same horizon, or where rooted specimens were observed. A more precise counting of the forests was hampered by two factors—the cover of modern vegetation on the lower slopes of the spur as well as the upper reaches on and immediately below the ridge, and the nearly precipitous nature of the terrain above the uppermost reaches of the West Fork, as is clearly indicated on the topographic sheet of the Park.

Modern vegetation covers the volcanics at about the 8,500-foot contour of the spur, and it is necessary to follow along in a westerly direction almost to the Left Fork. The breccias are well exposed in the stream bed and its immediate vicinity and above its uppermost limit for another 500 feet or more. Here six more forests were defined at less regular intervals. It is almost certain that the actual number preserved here must be at least twice that recorded, but due to the steepness of the slope most of the stumps do not remain long in position once they start to weather out.

The average vertical distance between the ten successive forests that were counted on the spur slope was about 25 feet, with a variation of about 15 to 35 feet. To determine the distance more exactly between forests would require leveling instruments and considerable excavation inasmuch as only occasionally are the stumps exposed to the roots. Since the area is most unique and a National Park as well, the latter treatment would hardly be justified. Thus, while evidences of sixteen successive eras of forest growth were found on the spur and the upper reaches of the Left Fork ravine it seems safe to suggest that half again that number would be revealed by more detailed study. Such evidence is hardly required to emphasize the spectacular nature of the forests.

On the second day we ascended the spur that lies between the two previously mentioned tributaries of Specimen Creek. The fossil forests are first met at a somewhat higher level here partly because the living vegetation cover extends up higher, and partly because the beds dip toward the southeast. Following this spur to about the 8,300-foot contour one may then traverse about 100 yards to the west into an exceedingly rugged ravine where numerous stumps are exposed through a vertical distance of some few hundreds of feet. The successive forests cannot be traced as clearly in this sector although it is of interest for the large size of some of the stumps, a Sequoia 14 feet in diameter being the largest that we encountered. Although a central core some 5 feet in diameter had been destroyed in this tree prior to fossilization a study of wood specimens from the remaining part of the trunk showed an average of 19 rings to the inch, indicating an age of about 1,600 years for the tree.

Unfortunately there were few evidences of well-preserved foliar remains in the territory that was covered. The forests do extend for some distance to the northwest, however, and it is possible that leaf impressions might be found at other points. If such were located the possibility of an ecological study is evident and should produce most interesting results. Aside from this the region is well worth a day's time for any naturalist with a paleontological bent.